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Effect of Water Content on the Characteristics of Bagasse Ash-Calcium Carbide Residue Stabilized Organic Soil

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ABSTRACT

Research about chemically stabilized organic soil to improve shear strength has been done by many researchers. However, they have never undertaken the research about the the effect of water content on physical and chemical characteristics of stabilized organic soil. Aset of experimental program performed in this research were chemical composition of organic soil (OS), calcium carbide residue (CCR) , and bagasse ash (BA); also the physical characteristics of OS. The admixture (60% CCR + 40% BA) was added to the soil with proportion 5, 10, 15, 20, 25 and 30% with various water content , and the samples were cured in 7, 14, 21, and 36 days- curing time. Then, the experiment of physical properties of the stabilized soil was undertaken. The physical characteristics of the stabilized soil change with respect to the water content, quantity of admixture and the curing times. On the high water content, the changes of the physical properties are more significant compared to that on the lower water content. The unit weight, specific gravity, and the degree of acidity increase whereas void ratio and organic content decrease according to the proportion of the admixtures and curing time.

Keywords : organic soil, calcium carbide, bagasse ash, physical and chemical characteristics.

PURPOSE OF STUDY

To investigate the effect of water content on the physical properties such as water content (w), specific gravity (G), unit weight(γ), and chemical properties such as organic content (Oc) and the degree of accidity (pH) of organic clay stabilized by bagasse ash and calcium carbide residue.

MATERIAL AND METHOD

Organic soil was taken from Ketapang Regency, The Province of West Kalimantan, Indonesia. The soil is fibrous peat with 95% organic content, and it is considered as soil with high organic content. The water content is 498% due to the properties of fiber that absorb water. The Laboratory tests of physical properties of the soil use the standard ASTM-1984 (Peat Testing Manual). The soil sample is still on the range of the previous research. Based onASTM D-4427-92, the soil is classified as moderate fibrous peat with high degree of acidity. Before mixed to the soil, calcium carbide residue (CCR) was oven dried and the bagasse ash (BA) was burned on 300OC to get the higher SiO2 +Al2O3 +Fe2O3. Then, the admixture was prepared to the proportion of 40% BA + 60%. The admixture, then, were mixed with the dry organic soil with the proportion of 5, 10, 15, 20, 25 and 30% with 498, 548 and 598% water content. To wait the pozzolanic reactions occurred , the stabilized soil then cured in 7, 14, 21, and 36 days of curing period. Finally, the specific gravity (G), the unit weight (γ), void ratio (e), degree of acidity (pH), organic content (Oc) of stabilized soil were tested.

RESULTS AND DISCUSSION

Water Content (w) Figure 1 and 2 are presentation of the relation between water content and binder proportion with various curing times. With respect to admixture proportion, the average decrease of water content is 300O. For example at 36 days curing time, at the initial water content 498% and 548% , the water content decrease to 150 and 155%. The decrease of water content is probably due to water absorbent during pozzolanic reaction that generate cementous agents filling out the pore in organic soil and covering peat-fibers .The decrease of water content, however, tends to be constant at 20% admixture and 21 days curing period because the ending of pozzolanic reaction. The trend is different from the stabilized an organic clay, the longer the curing period and the more admixture content, the pozzlanic reaction more intensively occur.

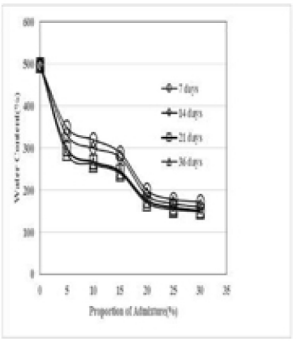

Figure 1. Proportion of Admixture vs. water content (w = 498%)

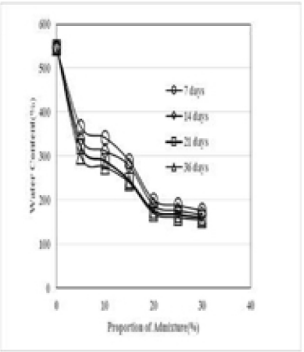

Figure 2. Proportion of Admixture vs. water content (w = 548%)

The Unit Weight (γ) Due to addition of admixtures in the organic soil, the unit weight of stabilzed soil improves parallel to the proportion of binder quantity (Fig.3). This improvement is due to the pozzolanic reaction generating calcium-silicatehydrate or aluminum-silicate-hydrate that fill out the pore and cover the soil fibers. However, the improvement of the unit weight of stabilized soil goes slowly , and tends to be constant after 20% proportion of admixture and 21 days curing period. It is due to lack of mineral in organic soil. With respect to the water content, the unit weight of stabilized soil significantly improve on 21 days curing time for both 5% and 20% admixtures (Fig.4). On 36 days curing period, on the other hand, there is no improvement of the unit weight on both 5% admixture and slightly improvement on 20% admixture. On 5% of admixture, the pozzolanic reaction does dot effectivelly occure , it results on small absorbtion of water for the reaction. On 20% admixture, however, the pozzolanic reaction intensivelly happpen that result on the improvement of the unit weight of stabilized organic soil.

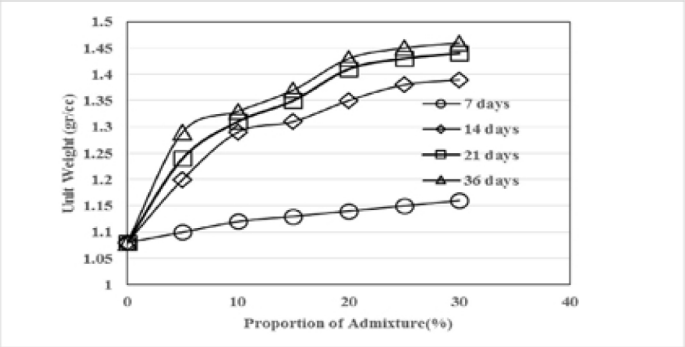

Fig. 3. Proportion of admixture-Unit weight (w = 498%)

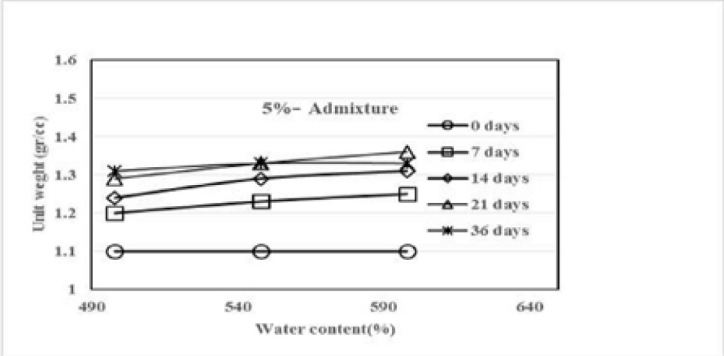

Fig. 4. Water content – Unit weight

Conclusion

A series of experimental program and analysis have been done, then the following conclusion can be drawn. The Ketapang Peat has high organic content, around 95%, that is classified as high organic content-peat. The binder was (40% bagasse ash + 60% calcium carbide residue). The bagasse ash has high content of silica, alumina and ferrit whereas calcium carbide has high CaO content, therefore combination of both materials with additional water generate the pozzolanic reaction. The water content, binder proportion and curing period improve the specific gravity, unit weight, and the degree of acidity of organic soil. And , they decrease the void ratio and organic content of stabilized soil. The optimum admixture proportion and curing period were fond 20% and 21 days curing period.

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